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EXAMINER

OH, TAYLOR V

ART UNIT	PAPER NUMBER
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1625

DATE MAILED: 05/07/2003

4

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Applicati n No.

09/936,184

Applicant(s)

UNVERRICHT ET AL.

Examiner

Taylor Victor Oh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 September 2001.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

The Status of the Claims:

Claims 1-31 are pending.

Claims 1-31 have been rejected.

***Claim Objections***

Claim 23 is objected to because of the following informalities: "O<sup>7</sup><sub>y</sub>" is written in the formula II. However, this does not match with the formula II in the specification on page 11. Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

Claims 1, 22-23, and 28-29 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the first fixed-bed catalyst or the second fixed bed catalyst or both, such as,  $\text{Mo}_{12}\text{Bi}_a\text{Fe}_b\text{X}^1_c\text{X}^2_d\text{X}^3_e\text{X}^4_f\text{O}_n$ , or  $(\text{Y}^1_c\text{Y}^2_d, \text{O}_x)_p[\text{Y}^1_c\text{Y}^2_d\text{Y}^1_c\text{Y}^2_e\text{Y}^1_c\text{Y}^2_f\text{O}_y]_q$  or  $\text{Mo}_{12}\text{V}_a\text{X}^1_b\text{X}^2_c\text{X}^3_d\text{X}^4_e\text{X}^5_f\text{X}^6_g\text{O}_n$  or  $[\text{Mo}_{12}\text{V}_a\text{Z}^1_b\text{Z}^2_c\text{Z}^3_d\text{Z}^4_e\text{Z}^5_f\text{Z}^6_g, \text{O}_x]_p[\text{Z}^7_{b2}\text{Cu}_h\text{H}_i\text{O}_x]_q$ , does not reasonably provide enablement for all the catalysts and the corresponding multiple combinations of the catalyst compositions known in the field of chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all the catalysts unrelated to the invention commensurate in scope with these claims.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without undue experimentation.

Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

- 1) the quantity of experimentation necessary,
- 2) the amount of direction or guidance provided,
- 3) the presence or absence of working examples,
- 4) the nature of the invention,
- 5) the state of the prior art,
- 6) the relative skill of those in the art,
- 7) the predictability of the art, and
- 8) the breath of the claims.

In the instant case, the claim encompasses various and multiple-combined catalysts.

However, applicants' specification provide only two particular exemplified catalyst compounds used in the examples according to the specification (pages 30-31).

Furthermore, the catalyst compositions represent an unpredictable aspect in the art of organic chemistry . See *Exparte Sizto*, 9 USPQ2d 2081 (Bd. Of App. And Inter. March 1988). Thus, the specification herein have failed to provide sufficient working examples

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to support the use of various and multiple-combined catalysts. Therefore, an appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

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4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-22, 27, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruppel et al (U.S. 5,821,390) in view of Ruppel et al (U.S. 5,739,391) and Etzkorn et al (U.S. 5,198,578).

Ruppel et al discloses a process for the catalytic gas-phase oxidation of propene to acrolein in a multiple contact tube fixed-bed reactor at an elevated temperature on the catalytically active multi-metal oxides with a propene conversion for a single pass of  $\geq 90$  mol % and an acrolein formation selectivity of  $\geq 85$  mol % (see col. 1, lines 5-14) in tube-bundle reactors (see col. 2, line 12).

Furthermore, a propene: oxygen: inert gases (including steam) ratio by volume of from 1: (1.0 to 3.0): (5 to 25) is used (see col. 5, lines 16-18); for example, a composition of the reaction-gas mixture: 5.4% by vol. of propene, 10.5 % by vol. of oxygen, 1.7 % by vol. of CO and CO<sub>2</sub>; 80.8 % by vol. of N<sub>2</sub> (see col. 8, lines 11-16). The reaction pressure is in the range from 1 to 3 bar and the overall space velocity is from 1500 to 2500 l (s.t.p.)/l/h (see col. 5, lines 15-21), the reaction temperatures are from 300<sup>0</sup> to 450<sup>0</sup> c. (see col. 4, lines 41-42) and also, the flow rate of the circulated heat-exchange medium is set so that its temperature may rise by from 2<sup>0</sup> to 10<sup>0</sup> C. (see col. 4, lines 29-30).

Moreover, if the acrolein is used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene, the reaction gases containing acrolein are transferred to the second oxidation step without removal of the secondary component (see col. 5 lines 22-28).

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Concerning the application of multi-metal oxide catalysts to the process, the reference presents the following formula I:  $\text{Mo}_{12}\text{Bi}_a\text{Fe}_b\text{X}^1_c\text{X}^2_d\text{X}^3_e\text{X}^4_f\text{O}_n$ , where

$\text{X}^1$  is nickel and /or cobalt,  
 $\text{X}^2$  is thallium, an alkali metal and/ or an alkaline earth metal,  
 $\text{X}^3$  is phosphorus, arsenic, boron, antimony, tin, cerium, lead and /or tungsten,  
 $\text{X}^4$  is silicon, aluminum, titanium, and /or zirconium,  
a is from 0.5 to 5,  
b is from 0.01 to 3,  
c is from 3 to 10,  
d is from 0.02 to 2,  
e is from 0 to 5,  
f is from 0 to 10 and  
n is a number determined by the valency and frequency of the elements other than oxygen. (see from col. 4 ,line 52 to col. 5 ,line 5).

The instant invention , however, differs from the Ruppel et al (U.S. 5,821,390) in that a molar ratio of oxygen and propene in the first and second stages is not mentioned; the specifications of the second fixed-bed catalyst along with reaction conditions are unspecified; and the temperature variations among the reaction zones A, B, C, and D are also unspecified.

Ruppel et al (U.S. 5,739,391) discloses a process for the catalytic gas-phase oxidation of acrolein to acrylic acid in a multiple contact tube fixed-bed reactor at an elevated temperature on the catalytically active multi-metal oxides with an acrolein conversion for a single pass of  $\geq 95$  mol % and an acrylic acid formation selectivity of  $\geq 90$  mol % (see col. 1 ,lines 5-11).

Furthermore, an acrolein: oxygen: inert gases ratio by volume of from 1: (1.0 to 3.0): (3 to 30) is used (see col. 4 ,lines 58-59). The reaction pressure is in the range

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from 1 to 3 bar and the overall space velocity is from 1000 to 2500 l (s.t.p.)/l/h (see col. 4 , lines 64-67), and the reaction temperature in the flow direction along the contact tubes from 260<sup>0</sup> to 300<sup>0</sup> c. and the reaction temperature can be lowered by a total of from 5 to 40<sup>0</sup> C.(see col. 3 ,lines 5-10).

In addition, concerning the application of multi-metal oxide catalysts to the process, the reference presents the following formula I: Mo<sub>12</sub>V<sub>a</sub> W<sub>b</sub>

Cu<sub>c</sub>Ni<sub>d</sub>X<sup>1</sup><sub>e</sub>X<sup>2</sup><sub>f</sub>X<sup>3</sup><sub>g</sub>X<sup>4</sup><sub>h</sub>X<sup>5</sup><sub>i</sub>O<sub>n</sub> , where

X<sup>1</sup> is one or more alkali metal ,  
 X<sup>2</sup> is one or more alkaline earth metal,  
 X<sup>3</sup> is chromium, manganese, cerium, and / or niobium,  
 X<sup>4</sup> is antimony and/or bismuth ,  
 X<sup>5</sup> is silicon, aluminum, titanium, and /or zirconium,  
 a is from 1 to 6,  
 b is from 0.2 to 4,  
 c is from 0.5 to 6,  
 d is from 0.2 to 6,  
 e is from 0 to 2,  
 f is from 0 to 3,  
 g is from 0 to 5,  
 h is from 0 to 40,  
 i is from 0 to 40,  
 and n is a number determined by the valency and frequency of the elements other than oxygen. (see col. 4 ,lines 28-48).

Moreover, Etzkorn et al (US 5,198, 578) teaches a process for oxidizing propylene to acrolein and the oxidation of propylene to acrylic acid in two stages (see col. 5 ,lines 48-51) : the first reactor tube contained a catalyst comprising molybdenum, bismuth, iron, and several promoter metals of first-stage catalyst and the second reactor tube also contained a second-stage catalyst similar to the previous ones(see from col. 11, line 65 to col.12, line 3) and furthermore, the acrolein produced in the first



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stage can be directed without separation to a second reactor operating in series (see col. 1, lines 25-30 ).

Furthermore, Etzkorn et al indicates that in the composition of the process feeds, the starting reactant gas mixture may contain 1.1 to 2.1 moles of molecular oxygen per mole of propylene (see from col. 7, line 65 to col. 8 ,line 1) .

With respect to the unspecified reaction zones A, B, C, and D with the temperature variations, the references are silent. However, the Ruppel et al does point out that the multiple contact tube fixed-bed reactor may contain many contact tubes; each of them corresponds to an extended reaction unit zone (see col. 1 ,lines 41-55). Furthermore, the flow rate of the circulated heat-exchange medium is set so that its temperature may rise by from  $2^{\circ}$  to  $10^{\circ}$  C. (see col. 4 ,lines 29-30) or according to the Ruppel et al(U.S. 5,739,391) , the reaction temperature can be lowered by a total of from  $5$  to  $40^{\circ}$  C.(see col. 3 ,lines 5-10). Therefore, it is within the purview of a skilled artisan in the art to have motivated to arrange the multiple contact tubes as an extended reaction unit zone in order to monitor the reaction temperature of each corresponding reaction zone, thereby avoiding shortening the life of the catalyst (see col. 2 ,lines 51-57).

Ruppel et al (U.S. 5,821,390) does disclose the process for the catalytic gas-phase oxidation of propene to acrolein in the multiple contact tube fixed-bed reactor at an elevated temperature. Also, if the acrolein is used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene, the reaction gases containing acrolein are

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transferred to the second oxidation step without removal of the secondary component.

Ruppel et al (U.S. 5,739,391) does teach the process for the catalytic gas-phase oxidation of acrolein to acrylic acid in the multiple contact tube fixed-bed reactor at an elevated temperature. In addition, Etzkorn et al (US 5,198, 578) does teach the process for oxidizing propylene to acrolein and the oxidation of propylene to acrylic acid with the specific molar ratio of molecular oxygen and propylene in two catalytic system-stages in series.

All the three processes are commonly involved in the process of producing the end product, acrylic acid. The Ruppel et al (U.S. 5,821,390) expressly indicates that the intermediate acrolein can be used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene, and similarly, Ruppel et al (U.S. 5,739,391) does focus the process for the catalytic gas-phase oxidation of acrolein to acrylic acid in the multiple contact tube fixed-bed reactor. Also, Etzkorn et al (US 5,198, 578) does offer the specific molar ratio of molecular oxygen and propylene in two catalytic system-stages in the process for oxidizing propylene to acrylic acid. Therefore, it would have been obvious to the skilled artisan in the art to have motivated to incorporate the teachings of the Ruppel et al (U.S. 5,821,390), along with Etzkorn's et al specific molar ratio of molecular oxygen and propylene, into the Ruppel et al (U.S. 5,739,391) process of producing acrylic acid. This is because the skilled artisan in the art would expect the combined processes to be successful as shown in the Ruppel et al (U.S. 5,821,390).

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Claims 1, 23-24, 29, and 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruppel et al (U.S. 5,821,390) in view of Ruppel et al (U.S. 5,739,391), Neumann et al (U.S. 5,364,825) and Etzkorn et al (U.S. 5,198,578).

Ruppel et al discloses a process for the catalytic gas-phase oxidation of propene to acrolein in a multiple contact tube fixed-bed reactor at an elevated temperature on the catalytically active multi-metal oxides with a propene conversion for a single pass of  $\geq 90$  mol % and an acrolein formation selectivity of  $\geq 85$  mol % (see col. 1, lines 5-14) in tube-bundle reactors (see col. 2, line 12).

Furthermore, a propene: oxygen: inert gases (including steam) ratio by volume of from 1: (1.0 to 3.0): (5 to 25) is used (see col. 5, lines 16-18); for example, a composition of the reaction-gas mixture: 5.4% by vol. of propene, 10.5 % by vol. of oxygen, 1.7 % by vol. of CO and CO<sub>2</sub>; 80.8 % by vol. of N<sub>2</sub> (see col. 8, lines 11-16). The reaction pressure is in the range from 1 to 3 bar and the overall space velocity is from 1500 to 2500 l (s.t.p.)/l/h (see col. 5, lines 15-21), the reaction temperatures are from 300<sup>0</sup> to 450<sup>0</sup> c. (see col. 4, lines 41-42) and also, the flow rate of the circulated heat-exchange medium is set so that its temperature may rise by from 2<sup>0</sup> to 10<sup>0</sup> C. (see col. 4, lines 29-30).

Moreover, if the acrolein is used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene, the reaction gases containing acrolein are transferred to the second oxidation step without removal of the secondary component (see col. 5 lines 22-28).

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Concerning the application of multi-metal oxide catalysts to the process, the reference presents the following formula I:  $\text{Mo}_{12}\text{Bi}_a\text{Fe}_b\text{X}^1_c\text{X}^2_d\text{X}^3_e\text{X}^4_f\text{O}_n$ , where

$\text{X}^1$  is nickel and /or cobalt,  
 $\text{X}^2$  is thallium, an alkali metal and/ or an alkaline earth metal,  
 $\text{X}^3$  is phosphorus, arsenic, boron, antimony, tin, cerium, lead and /or tungsten,  
 $\text{X}^4$  is silicon, aluminum, titanium, and /or zirconium,  
a is from 0.5 to 5,  
b is from 0.01 to 3,  
c is from 3 to 10,  
d is from 0.02 to 2,  
e is from 0 to 5,  
f is from 0 to 10 and  
n is a number determined by the valency and frequency of the elements other than oxygen. (see from col. 4 ,line 52 to col. 5 ,line 5).

The instant invention , however, differs from the Ruppel et al (U.S. 5,821,390) in that a molar ratio of oxygen and propene in the first and second stages is not mentioned; the temperature variations among the reaction zones A, B, C, and D are also unspecified ; the first fixed-bed catalyst comprises annular and/or spherical catalysts; the first fixed-bed catalyst has one multimetal oxide of the formula II; and the second fixed-bed catalyst has one multimetal oxide of the formula IV .

Ruppel et al (U.S. 5,739,391) discloses a process for the catalytic gas-phase oxidation of acrolein to acrylic acid in a multiple contact tube fixed-bed reactor at an elevated temperature on the catalytically active multi-metal oxides with an acrolein conversion for a single pass of  $\geq 95$  mol % and an acrylic acid formation selectivity of  $\geq 90$  mol % (see col. 1 ,lines 5-11).

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Furthermore, an acrolein: oxygen: inert gases ratio by volume of from 1: (1.0 to 3.0): (3 to 30) is used (see col. 4 ,lines 58-59). The reaction pressure is in the range from 1 to 3 bar and the overall space velocity is from 1000 to 2500 l (s.t.p.)/l/h (see col. 4 , lines 64-67), and the reaction temperature in the flow direction along the contact tubes from 260<sup>0</sup> to 300<sup>0</sup> c. and the reaction temperature can be lowered by a total of from 5 to 40<sup>0</sup> C.(see col. 3 ,lines 5-10).

In addition, concerning the application of multi-metal oxide catalysts to the process, the reference presents the following formula I:  $\text{Mo}_{12}\text{V}_a\text{W}_b$

$\text{Cu}_c\text{Ni}_d\text{X}^1_e\text{X}^2_f\text{X}^3_g\text{X}^4_h\text{X}^5_i\text{O}_n$ , where

$\text{X}^1$  is one or more alkali metal ,  
 $\text{X}^2$  is one or more alkaline earth metal,  
 $\text{X}^3$  is chromium, manganese, cerium, and / or niobium,  
 $\text{X}^4$  is antimony and/or bismuth ,  
 $\text{X}^5$  is silicon, aluminum, titanium, and /or zirconium,  
a is from 1 to 6,  
b is from 0.2 to 4,  
c is from 0.5 to 6,  
d is from 0.2 to 6,  
e is from 0 to 2,  
f is from 0 to 3,  
g is from 0 to 5,  
h is from 0 to 40,  
i is from 0 to 40,  
and n is a number determined by the valency and frequency of the elements other than oxygen. (see col. 4 ,lines 28-48).

Moreover, Etzkorn et al (US 5,198, 578) teaches a process for oxidizing propylene to acrolein and the oxidation of propylene to acrylic acid in two stages (see col. 5 ,lines 48-51) : the first reactor tube contained a catalyst comprising molybdenum, bismuth, iron, and several promoter metals of first-stage catalyst and the second reactor tube also contained a second-stage catalyst similar to the previous ones(see

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from col. 11, line 65 to col.12, line 3) and furthermore, the acrolein produced in the first stage can be directed without separation to a second reactor operating in series (see col. 1, lines 25-30 ).

Furthermore, Etzkorn et al indicates that in the composition of the process feeds, the starting reactant gas mixture may contain 1.1 to 2.1 moles of molecular oxygen per mole of propylene (see from col. 7, line 65 to col. 8 ,line 1) .

In addition, Neumann et al teaches multi-metal oxide compositions which can be used for preparing unsaturated carboxylic acids by the gas-phase catalytic oxidation of alkenes (see col. 4 , lines 56-60) : the formula I of  $[X^1_a X^2_b O_x]_p [X^3_c X^4_d X^5_e X^6_f X^7_g X^2_h O_y]_q$  where

$X^1$  is bismuth, tellurium, antimony, tin and /or copper,  
 $X^2$  is molybdenum, and or tungsten,  
 $X^3$  is an alkali metal, thallium, and/or samarium,  
 $X^4$  is an alkaline earth, nickel, cobalt, copper ,  
 $X^5$  is iron, chromium, cerium, and /or vanadium,  
 $X^6$  is phosphorus, arsenic, boron, and/ or antimony ,  
 $X^7$  is a rare-earth metal , titanium, zirconium, niobium, tantalum, rhenium, ruthenium, rhodium, silver, gold, aluminum, gallium, indium, silicon, germanium, lead, thorium, and /or uranium,

a is from 0.01 1 to 8,

b is from 0.1 to 30,

c is from 0 to 4,

d is from 0 to 20,

e is from 0 to 20,

f is from 0 to 6,

g is from 0 to 15,

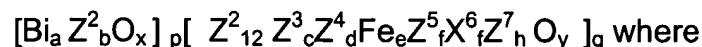
h is from 8 to 16,

x and y are numbers determined by the valency and frequency of the elements in I other than oxygen, and p and q are numbers whose ratio p/q is from 0.1 to 10, and a chemical composition  $[X^1_a X^2_b O_x]$  which are delimited from the their local environment due to their chemical composition and whose maximum diameters are from 1 to 25 micrometer

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(see col. 1 ,lines 5-40). The SiO<sub>2</sub> particles are substantially spherical (see col. 3 , lines 66-67).

Furthermore, Neumann et al teaches the formula III of multi-metal oxide compositions:



Z<sup>2</sup> is molybdenum and or tungsten ,

Z<sup>3</sup> is nickel and cobalt,

Z<sup>4</sup> is thallium, an alkali metal and/ or an alkaline earth ,

Z<sup>5</sup> is phosphorus, arsenic, boron, and/ or antimony,

Z<sup>6</sup> is silicon, aluminum, titanium, and /or zirconium,

Z<sup>7</sup> is copper, silver, and/ or gold,

a is from 0.1 to 1,

b is from 0.2 to 2,

c is from 3 to 10,

d is from 0.02 to 2,

e is from 0.01 to 5,

f is from 0 to 5,

g is from 0 to 10,

h is from 0 to 1,

x and y are numbers determined by the valency and frequency of the elements in I other than oxygen, and p and q are numbers whose ratio p/q is from 0.1 to 5, and Z<sup>2</sup><sub>b</sub> is tungsten and Z<sup>2</sup><sub>12</sub> is molybdenum ; (see col . 3, lines 1-25). Moreover, the calcinations temperature is from 400 to 900° C. (see col . 4, lines 5-6).

With respect to the unspecified reaction zones A, B, C, and D with the temperature variations, the references are silent. However, the Ruppel et al does point out that the multiple contact tube fixed-bed reactor may contain many contact tubes; each of them corresponds to an extended reaction unit zone (see col. 1 ,lines 41-55). Furthermore, the flow rate of the circulated heat-exchange medium is set so that its temperature may rise by from 2° to 10° C. (see col. 4 ,lines 29-30) or according to the Ruppel et al(U.S. 5,739,391) , the reaction temperature can be lowered by a total of

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from 5 to 40<sup>0</sup> C.(see col. 3 ,lines 5-10). Therefore, it is within the purview of a skilled artisan in the art to have motivated to arrange the multiple contact tubes as an extended reaction unit zone in order to monitor the reaction temperature of each corresponding reaction zone, thereby avoiding shortening the life of the catalyst (see col. 2 ,lines 51-57).

Concerning the shapes of the catalysts, the references do not mention their shapes. However, this is not directly related to the patentability of the invention. The catalysts may have various shapes and various colors. This particular limitation does not have any patentable weight over the prior art references.

Ruppel et al (U.S. 5,821,390) does disclose the process for the catalytic gas-phase oxidation of propene to acrolein in the multiple contact tube fixed-bed reactor at an elevated temperature. Also, if the acrolein is used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene, the reaction gases containing acrolein are transferred to the second oxidation step without removal of the secondary component. Ruppel et al (U.S. 5,739,391) does teach the process for the catalytic gas-phase oxidation of acrolein to acrylic acid in the multiple contact tube fixed-bed reactor at an elevated temperature. Also, Etzkorn et al (US 5,198, 578) does teach the process for oxidizing propylene to acrolein and the oxidation of propylene to acrylic acid with the specific molar ratio of molecular oxygen and propylene in two catalytic system-stages in series. In addition, Neumann et al teaches multi-metal oxide compositions



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(Formula I and III) which can be used for preparing unsaturated carboxylic acids by the gas-phase catalytic oxidation of alkenes.

All the four processes are commonly involved in the process of producing acrylic acid. The Ruppel et al (U.S. 5,821,390) expressly indicates that the intermediate acrolein can be used to prepare acrylic acid by two step catalytic gas-phase oxidation of the propene. Similarly, Ruppel et al (U.S. 5,739,391) does focus the process for the catalytic gas-phase oxidation of acrolein to acrylic acid in the multiple contact tube fixed-bed reactor. Also, Etzkorn et al (US 5,198, 578) does offer the specific molar ratio of molecular oxygen and propylene in two catalytic system-stages in the process for oxidizing propylene to acrylic acid. And Neumann et al does teach the application of multi-metal oxide compositions (Formula I and III) to the process of producing unsaturated carboxylic acids by the gas-phase catalytic oxidation of alkenes.

Therefore, if the skilled artisan in the art had desired to employ Neumann's et al multi-metal oxide compositions as an alternative to the Ruppel's et al metal oxide compositions, it would have been obvious to the skilled artisan in the art to have motivated to incorporate the Neumann's et al multi-metal oxide compositions, along with Etzkorn's et al specific molar ratio of molecular oxygen and propylene, into the Ruppel et al (U.S. 5,739,391) process of producing acrylic acid. This is because the skilled artisan in the art would expect the combined processes to be successful as shown in the Neumann's et al process.

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The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Murib (U.S. 4,499,301) discloses a process for preparing acrolein and acrylic acid by the oxidation of propylene in the presence of a catalyst composition containing a noble metal promoted by a solid acid consisting of mixed metal oxides at the reaction temperature at about 100<sup>0</sup>- 250<sup>0</sup>C..

Ushikubo et al (U.S. 5,380,933) discloses a process for producing an unsaturated carboxylic acid in which an alkane is subjected to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a mixed metal oxide comprising Mo, V, Te, and X at a reaction temperature of from 200<sup>0</sup>- 550<sup>0</sup>C..

Bartek et al (U.S. 5,198,580) discloses a process for partial oxidation of propane to yield acrylic acid, propylene, acrolein, acetic acid, and carbon oxides by the reaction of propane in admixture with a molecular oxygen containing gas in a reaction zone with a catalyst containing Bi<sub>6</sub>Mo<sub>6</sub> V<sub>6</sub>A<sub>6</sub>D<sub>6</sub>E<sub>6</sub> O. at a pressure of 20 psig and a temperature of 400<sup>0</sup> C..

Caliahan (U.S. 2,941,007) discloses a method for producing an acrolein from propylene by catalytic oxidation using a catalyst consisting of bismuth molybdate and bismuth phosphomolybdate.

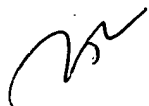
Herbst et al(U.S. 5,855,743) discloses a process of isolating (meth)acrylic acid from a mixture containing (meth)acrylic acid and lower aldehydes by rectification in a rectification column having a stripping section and a rectification section.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Taylor Victor Oh whose telephone number is 703-305-0809. The examiner can normally be reached on 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alan Rotman can be reached on 703-308-4698. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-2742 for regular communications and 703-305-7401 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1235.



May 3, 2003



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SPE 1625